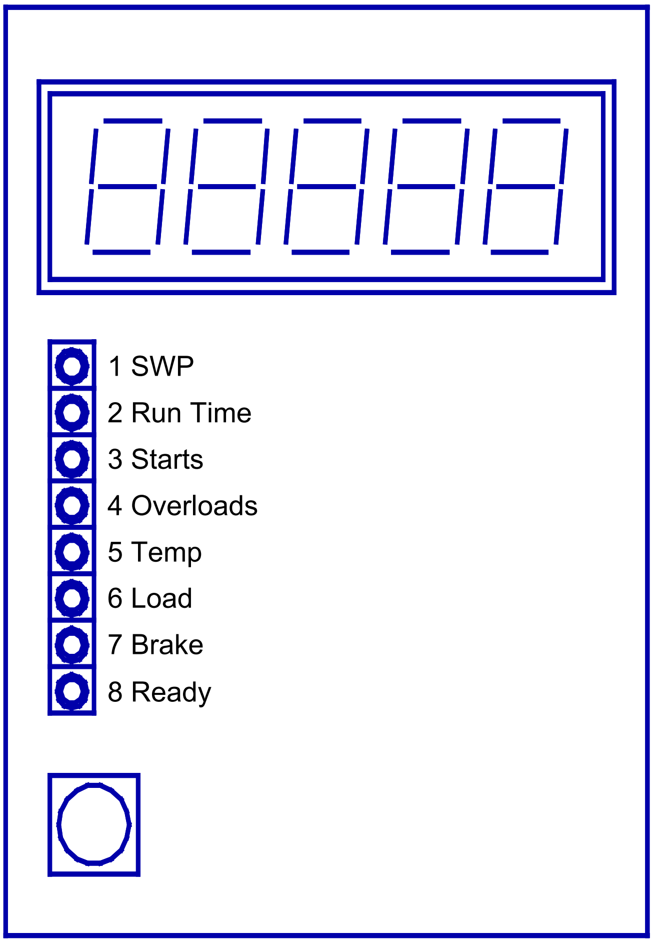
ELECTRONIC HOIST CONDITION MONITORING UNIT AND OVERLOAD PROTECTOR

CU1

In this manual, a sign e.g. '≥ P2.10' means that the concerned feature is present with the P2.10 and later program versions



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1 DESCRIPTION

CU1 is an electronic device for protecting the hoist from instant or cumulative overloads. CU1 also monitors and handles other safety related situations.

CU1's microprocessor-based implementation has made it possible to include all the following supervisory functions with XL-hoists:

1 Calculating the hoist's Safe Working Period (SWP)
2 Measuring operating hours (Run Time)
3 Counting the number of starts (Starts)
4 Counting overloading incidents (Overloads)
5 Overheating protection of the hoist motor (Temp)
6 Overload protection (Load)
7 Control of the hoist brake's wearing (Brake).

Specially-designed electronics and software guarantee the reliability of CU1 as a safety device. Diversified self-checking also ensures safe operation.

Independent tests have been carried out to ensure that the unit conforms to the strictest safety regulations.

Figure 1 shows the system level connections of CU1.

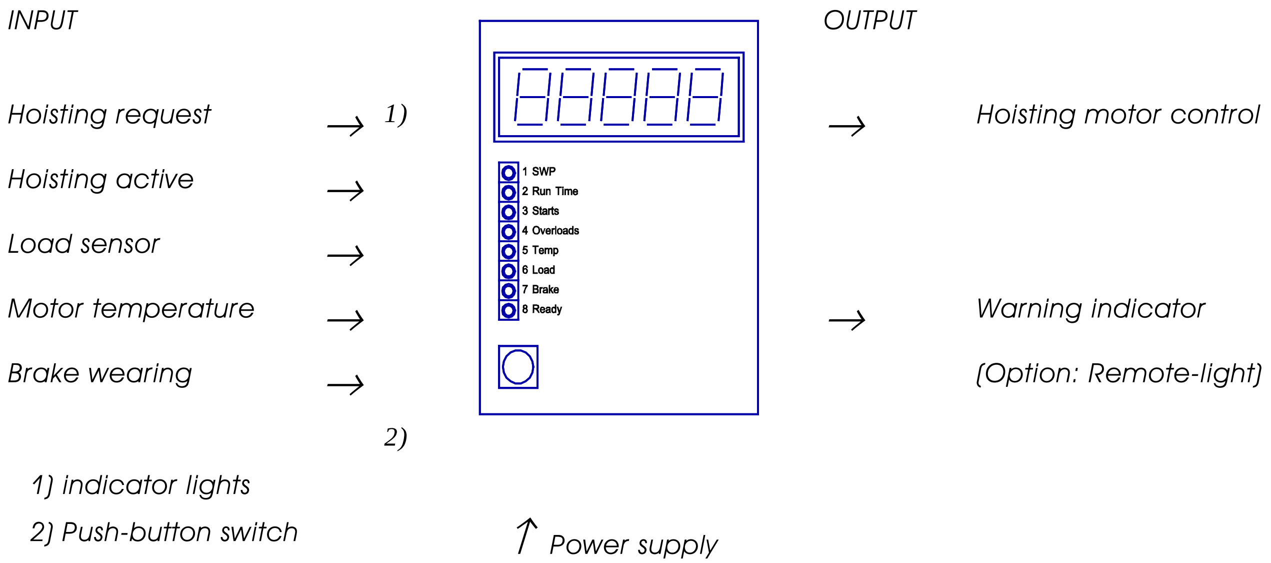


Figure 1: System level connections of CU1.

Note: CU1 is a safety device. To bypass or remove a CU1 is prohibited, because all supervisory and safety features would be removed!

2 FRONT PANEL AND DISPLAY INFORMATION

2.1 Numerical display

The 5-digit numerical display indicates the current values of the main supervisory functions and maintenance-related information.

The numerical display is blank when hoisting motion is running.

2.2 Supervisory values: SWP*, Run Time, Starts, Overloads*

The first 4 green lights on CU1's front panel indicate which value is currently displayed on the numerical display. Each value is shown for ca. 4 seconds, one after each other. If a supervisory value is reached the supervisory warning limit, READY-led, starts blinking (≥P2.13: 5 sec ON, 1 sec OFF,...).

	[color]	
1 SWP on display	[green]	(see chapter 3.1)
2 Run Time on display	[green]	(see chapter 3.2)
3 Number of Starts on display	[green]	(see chapter 3.3)
4 Number of Overloads incidents on display	[green]	(see chapter 3.4)

2.3 Safety functions: Temp*, Load and Brake*

The next 3 red lights on CU1's front panel indicate that the CU1 is in an alarm state (or in warning state) and hoisting motion is (or will be) prevented. A red light on indicates by which sensor the alarm is detected.

	[color]	
5 Alarm due to overheating: Temp	[red]	(see chapter 3.5)
6 Alarm due to overloading: Load	[red]	(see chapter 3.6)
7 Alarm due to brake wearing: Brake	[red]	(see chapter 3.8)

2.4 Indicator light: Ready

The last green Ready-light on CU1's front panel indicates the functional status of hoisting; normally it is on continuously. In an alarm or warning state it blinks (blinking frequency is 2 Hz in the alarm state and 1 Hz the warning state.

		[color]	
8	Functional status of hoisting: Ready	[green]	(see chapters 3.1 - 3.8)

2.5 Remote indicator (optional equipment)

The remote-indicator output corresponds in the same way as the Ready-light unless it is programmed to indicate e.g. OVERLOAD situation by e.g. an external alarm horn/lamp (Functional Options 5 and 6). Normally, the remote light is a signal lamp that can be mounted e.g. on the door of the bridge cubicle.

2.6 Load display

In the load mode CU1 displays the weight of the load as a percentage of the rated load of the hoist.

A CU1 can be changed into the load mode by pressing the blue push-button once.

By pressing the blue push button once again the display of CU1 returns to the normal mode.

Example:

A load of 4000 kg on a 5000 kg hoist is displayed as a load value of ca. L__80 (i.e. 4000 kg / 5000 kg * 100 % = 80 %).

Note that the accuracy of the load sensor is ca. ± 2% with the rated load of the hoist, but it may be poorer than ± 5% with light loads!

Load display range (unless Err_d displayed):

-Program versions P2.00 - P2.11	-20...120%
-Program version P2.12 -	-99...127%

2.7 Error messages

CU1 displays an error message in an abnormal situation due to an

-external failure (sensor, voltage, wiring etc.) or
-internal failure (CU1).

The error messages are presented in Appendix 2.

2.8 Program version

The program version of the CU1 (e.g. P2.12) is shown for 1 second after switching power on.

2.9 Programming and controlling of CU1

CU1 can be programmed and controlled by the blue push-button control switch on CU1's front panel's lower left hand corner.

CU1 can be changed into the programming and controlling mode by pressing the blue push-button continuously until the 'PAUSE'-message is displayed (ca. for 5 seconds).

In the beginning of the programming and controlling mode, CU1 asks for a password. A password is always a three digit number from 000 to 999. The correct password is entered by pressing the blue push-button when the corresponding digit is flashing. If you miss the correct digit, wait until it appears the next time around. Each digit is presented maximum of three times.

3 SUPERVISORY AND SAFETY FUNCTIONS

A warning is given when a safety risk is sensed beforehand, and the hoisting motion is immobilized in the event of a safety risk. Note that the CU1 is connected in the lifting circuit only and thus lowering of the load is always possible.

All basic parameters are factory-set and they are based on the FEM standards (Federation Europeenne de la Manutention). See chapter 5.

Note 1:

When the built-in maximum value of SWP, Run Time, Starts or Overloads is reached, it is still possible to use lifting and lowering motions, but the use of the hoist has exceeded a safety limit according to the selected hoist class. In this case, the hoist should be totally checked and renewed according to the instructions by KCI Konecranes.

3.1 Calculating of the hoist's Safe Working Period (*SWP*)

CU1 calculates and displays the remaining hoist's safe working period (SWP) in hours. The calculation basis on the design rules of the FEM-standards (see chapter Safe Working Period in Service Manual or in Owners Manual). According the FEM-standards the calculation has to be based on the load spectra and the corresponding operating hours. The CU1 calculates the SWP continuously and the calculation is based accurately on the measured load (Q) and the running time (t) during each work cycle:

$$SWP_2 = SWP_1 - \int (Q^3 * t)dt$$

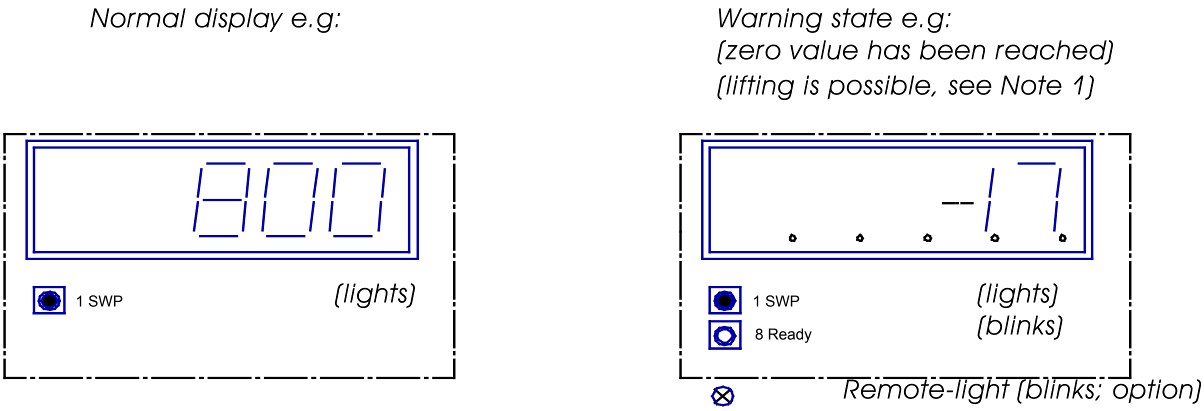
The displayed value is the remaining safe working period with the rated (100 %) load of the hoist in the selected hoist class and according the very heavy load spectra. SWP indicates how many hours the hoist can still be used with the rated load according to the selected hoist class.

During inspection the existing SWP has to be checked.

When SWP is reaching the value zero the hoist may only be used after an inspection called general overhaul has been carried out.

When SWP is reaching the value zero, please contact the KCI Konecranes Service organization.

If the zero value is reached, a negative SWP value is displayed and CU1 shifts into the warning state and the Ready-light (and the Remote-light) starts blinking (see Figure 2).


Normal display e.g:

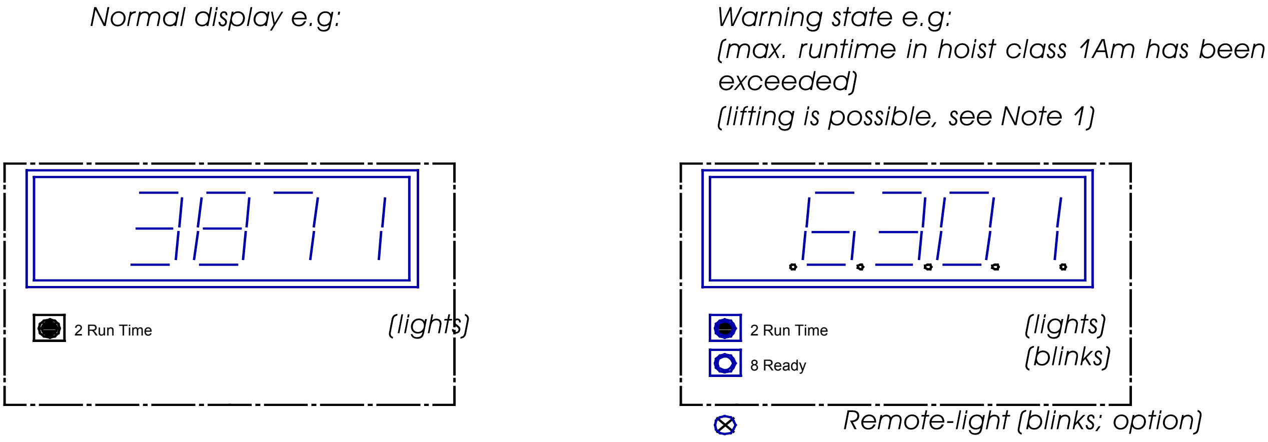
Warning state e.g:
(zero value has been reached)
(lifting is possible, see Note 1)

Figure 2: Indications of 'SWP'.

3.2 Measuring of the running hours (*Run Time*)

CU1 measures and displays the number of hours the hoisting machinery has been in operation (running up or down).

When the built-in maximum value according to the selected hoist class is reached (see table, chapter 5) CU1 shifts into the warning state and the Ready-light (and the Remote-light) starts blinking (see Figure3).


Normal display e.g:

Warning state e.g:
(max. runtime in hoist class 1Am has been exceeded)
(lifting is possible, see Note 1)

Figure 3. Indications of 'Running Time'.

3.3 Counting of the number of starts (*Starts*)

CU1 counts the number of starts of the hoisting machinery and displays the total number of starts in the units of thousands (i.e. starts/1000 is displayed).

When the built-in maximum value according to the selected hoist class is reached (see table in chapter 5), CU1 shifts into the warning state and the Ready-light (and the Remote-light) starts blinking (see Figure 4).

Normal display e.g:

Warning state e.g:
(max. number of starts in hoist class 2Am has been exceeded)
(lifting is possible, see Note 1)

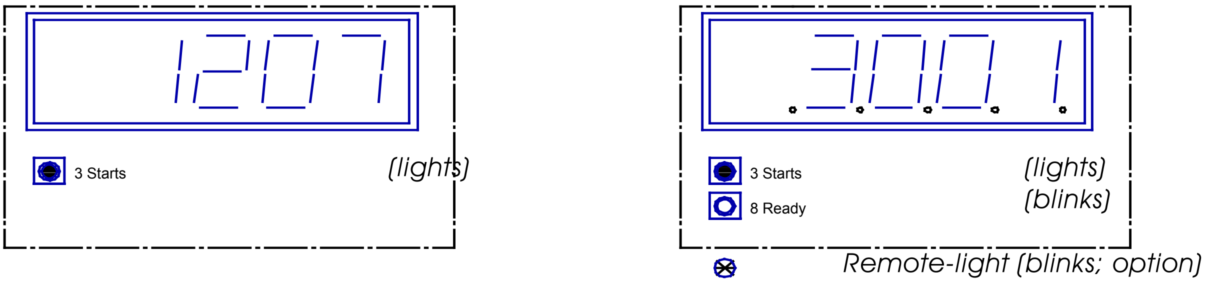
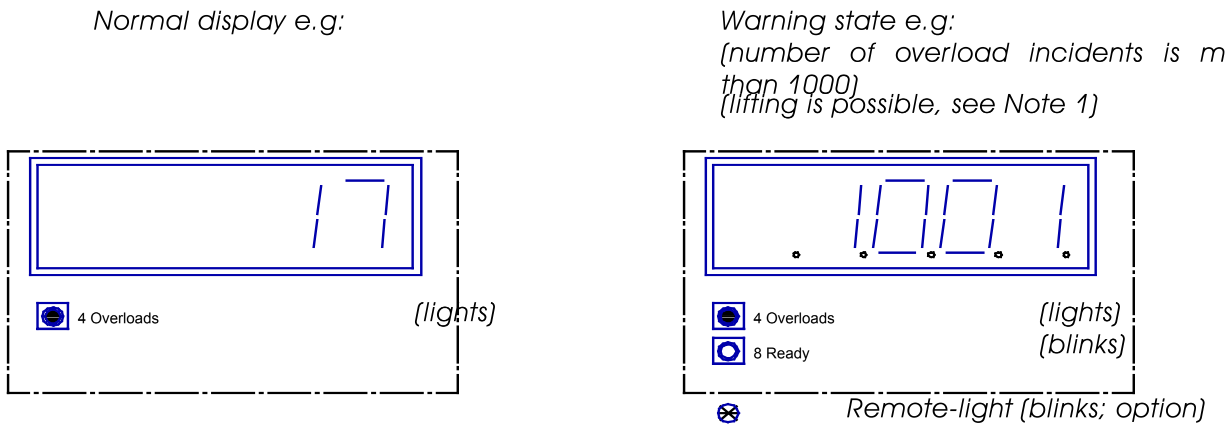


Figure 4: Indications of the number of 'Starts'.

3.4 Counting of overload incidents (*Overloads*)

CU1 counts and displays the number of times the hoisting motion is immobilized due to overloading. The overloads reading on the display is updated after 5 seconds standstill.

When the built-in maximum value (according to the selected hoist class) is reached (1000 overload incident in all hoist classes), CU1 shifts into the warning state and the Ready-light (and the Remote-light) starts blinking (see Figure 5).



Normal display e.g:

Warning state e.g:
(number of overload incidents is more than 1000)
(lifting is possible, see Note 1)

Figure 5: Indications of the number of 'Overloads'.

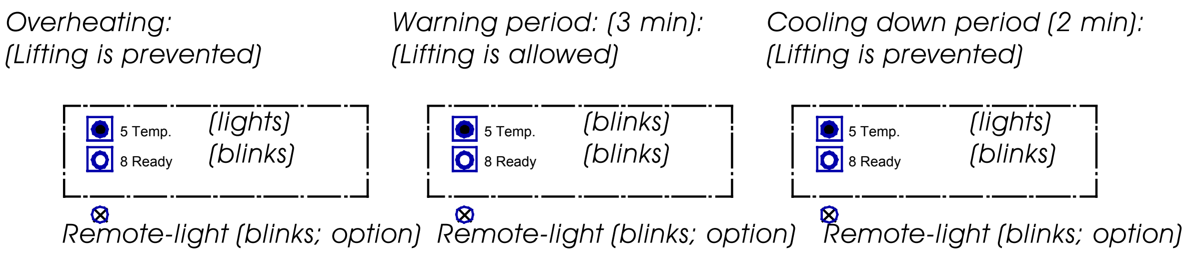
3.5 Overheating protection of the hoisting motor (*Temp*)

The temperature of the hoisting motor is measured by PTC thermistors. If overheating is detected (resistance of the thermistors is more than 4,2 kW), CU1 prevents the hoisting motion and shifts into a 3 minutes warning period. The lowering of the load is still allowed.

Hoisting is allowed during the warning period (3 min) if the temperature of the motor returns (and remains) back to normal.

If the overheating occurs again within the warning period, CU1 prevents hoisting motion for 2 minutes to cool down the motor (the cooling down period).

After the cooling down period (2 min) a new warning period (3 min) begins (see Figure 6).



Overheating:
(Lifting is prevented)

Warning period: (3 min):
(Lifting is allowed)

Cooling down period (2 min):
(Lifting is prevented)

Figure 6: Indications of 'Overheating'.

3.6 Overload protection (*Load*)

If the hoist is overloaded by more than 10 % (i.e. load is more than 110 %) for at least 0.75 seconds time, the hoisting motion is immediately prevented. Lowering of the load is still allowed. (Hoisting motion is also prevented if a CU1 notices that the weight of load is less than -20 %.)

The red Load-light is lit and the Ready-light (and the Remote-light) blinks as long as the overloading situation exists (See Figure 7).

Normal display e.g:
(display in load mode)

Overloading e.g:
(Display in load mode)
(Lifting is prevented)

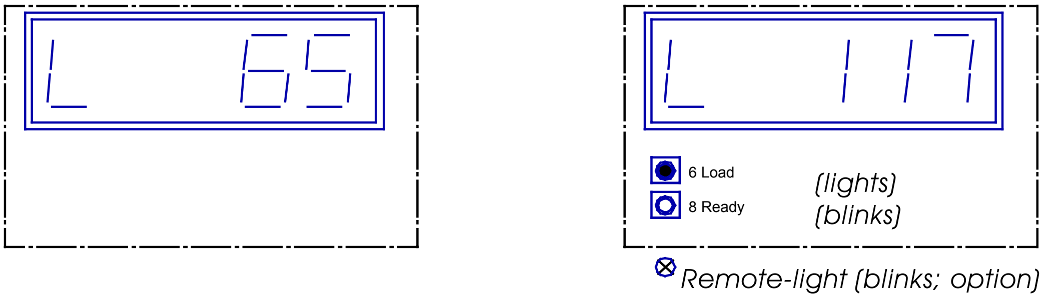


Figure 7: Indications of 'Load'.

3.7 Detection of the hoisting motor's brake wearing (*Brake*)

If CU1 detects an excessive wear of the hoisting motor's brake, CU1 shifts into a warning state and the Brake-light as well as the Ready-light (and the Remote-light) start blinking.

Note that CU1 checks brake wearing only when hoisting motor is started.

A maximum of 100 starts is allowed during the warning period. If the brake is not renewed the red Brake-light turns on and the hoisting motion will be prevented until the brake has been renewed and (see Figure 8).

Note: The warning state will be cancelled after 10 starts with the renewed brake.

The brake wear sensor is a 'wire loop' inside the friction material of the hoisting motor's brake. If the 'wire loop' is opened or if it contacts ground (PE), CU1 detects that the brake has worn out too much and the brake should be renewed.

Warning period, max. 100 starts:

(Brake wear sensor is cut off)
(Lifting is allowed)

Brake is not renewed during the warning period:
(Brake wear sensor is cut off)
(Lifting is prevented)

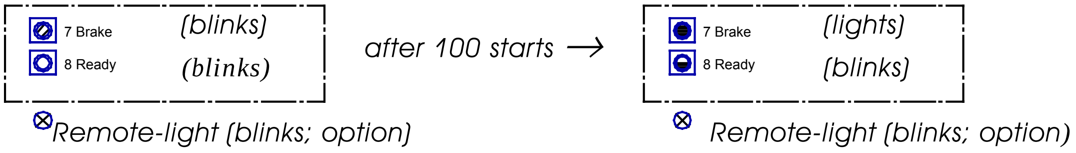


Figure 8: Indications of the 'Brake wearing'.

3.8 Brake status supervision

Some brakes are equipped with a micro switch that indicates the status of the brake i.e. if the brake is closed or open.

For that case the brake detector circuit must be see programmed seperately and the brake wear sensor is connected in the same circuit with the micro switch.

4 STARTUP ROUTINE

Before carrying out the startup routine, make it clear to yourself what is the difference between the startup and setup routines.

During the *startup routine* one checks that the *setup routine* has been carried out correctly - i.e. the load sensor has been calibrated and the hoist class has been set correctly.

4.1 Checking of the calibration and operation of the CU1

1 Check that all electrical connections have been done correctly.

2 Switch the power on.

CU1 runs a self-test program and the version of the program e.g. 'P2.03' is shown on the display for about 1 second.

CU1 also displays the selected/valid functional options (≥P2.12, see Appendix 6).

3 Check the calibration of the load sensor

Note:

The load sensor has been calibrated at the hoist factory on all new hoists and thus, normally, it is not necessary to calibrate it again.

Change the display into the load mode by pressing the blue push-button once (see Chapter 2.6, 6) and check the calibration of the load sensor:

a) Check that the load display shows ca. 'L 00' when there is no load on the hook.

b) Lift a load as close to the rated load of the hoist as possible (max. 110 %) and check again the load displayed.

Note:

If the load displayed differs more than ±5 % from the correct load value, check the load sensor and if necessary, carry out the setup routine to recalibrate the load sensor.

4 Check CU1's ability to prevent hoisting

At this stage you check that the CU1 is able to prevent hoisting; hoisting is prevented in the beginning of the programming and controlling mode. Lowering is always possible.

a) Change the CU1 into the programming and controlling mode by pressing the blue push-button until the 'PAUSE'-message appears. Release the push-button.

Note:

The CU1 asks for the first password, but DO NOT give any passwords at this point (you are not going to setup the CU1 but just testing that it operates correctly).

b) Try to lift and check that the CU1 prevents hoisting. Check also that lowering is possible.

c) Enter value 1-000 at password_1 to exit the programming and controlling mode.

(Select each password digit by pressing the blue push-button when the correct number is flashing.)

4.2 Load test

When the crane is overloaded during the (over)load test, it is possible to bypass CU1's safety functions by entering value 1-125 at password_1.

Note:

When CU1 is bypassed all safety features are bypassed as well. (The overheating protection and detecting of brake wearing are also omitted during the (over)load test if the program version is earlier than P2.12).

Note:

The hoist can also be equipped with an electro mechanical overload limit switch. Normally, it is adjusted to stop the hoisting motion at loads above 125 % and thus, there is no need to bypass it.

1 Change the CU1 into the bypass mode and carry out the (over)load test

a) Change the CU1 into the bypass mode by entering the value 1-125 at password_1.

During the bypass mode the 'CLOSE'-message is shown on the display.

b) Carry out the (over)load test of the crane.

c) Exit the bypass mode by pressing once the blue push-button. The bypass mode is also automatically aborted after 30 minutes or when the power is switched off.

4.3 Checking of selected functional options

CU1 includes (≥P2.12) some functional options that must be programmed i.e. selected case by case. The operation of those must be checked option by option (see Appendix 6).

The selected functional options can be checked by a password 1-000.

5 SETUP ROUTINE

Before carrying out the setup routine make it clear to yourself what is the difference between the setup and startup routines.

During the setup routine one sets the hoist class and calibrates the load sensor (a test load is needed during the setup routine).

Note: The setup routine is normally carried out at the hoist factory on all new hoists and thus, normally, it is not necessary to carry out the setup routine again.

Note:

Read through the whole setup routine instruction and make sure that you are familiar with all steps and effects of the *setup routine* before you start.

CU1 is a safety device. Programming is allowed by specially trained people only. If necessary, please contact the KCI Konecranes Service organization.

Lifting of the test load is permitted in step 3 only.

1 Change the CU1 into the programming and controlling mode

a) Change the CU1 to the beginning of the programming and controlling mode by pressing the blue push-button until the 'PAUSE'-message appears. Release the push-button.

b) Change the CU1 into the programming and controlling mode by entering value 1-630 at password_1.

2 Change the CU1 into the setup mode by selecting the procedure in calibrating the load sensor (calibration with a load as close to the rated load of the hoist as possible is always recommended, i.e. procedure 1 or 3):

There are four ways to calibrate the load sensor according to the weight of the test load. Procedure is selected by password_2:

Proc. 1: 2-611 Calibration with the rated load of the hoist (100%).

Proc. 2: 2-622 Calibration with a known load, 50...99 % of the hoist's rated load. This is allowed only in cases that the rated load of the hoist is not available. However, if there is an overload device with so called 'plate springs', the load sensor should always be calibrated with the rated load (or 110 %) in order to achieve the required accuracy at a 110 % load. (Normally, XL100-XL400 hoists on LA-trolleys are equipped with a 'plate spring' overload device.)

Proc. 3: 2-601 Calibration with the 110% load (≥ P2.12).

Proc. 4: 2-645 Calibration with the 125% load (≥ P2.12)

Continue on step a1, a2, a3 or a4 according to the weight of the test load.

a1) Enter value 2-611 at password_2 to calibrate the load sensor with the rated load of the hoist.

a2) Enter value 2-622 at password_2 to calibrate the load sensor with a test load of 50-99 % of the rated load of the hoist.

Calculate the percentage value of the test load compared to the rated load of the hoist. After entered password_2, display will ask for the percentage calculated.

Enter the calculated load percentage value as 'SL xx'.

Example:

A test load of 4000 kg on a 5000 kg hoist gives the percentage value of SL 80 (i.e. 4000 kg / 5000 kg * 100 % = 80 %).

a3) Enter value 2-601 at password_2 to calibrate the load sensor with the 110 % load.

a4) Enter value 2-645 at password_2 to calibrate the load sensor with the 125 % load.

3 Select the hoist class

The hoist class, 1Bm - 5m, is entered by the codes given in Table 1. The hoist class can be seen on the hoist's data label.

a) Enter the valid hoist class code CL 1 - CL 6 (1Bm - 5m) according to Table 1. Press the blue push-button when the correct hoist class code is displayed.

Table 1. Hoist class codes and preset values according to the FEM and ISO standards.

Code on CU1	Hoist class		SWP [h]	Run time [h]	Starts	Overloads
	FEM	ISO				
CL0	Keeps the earlier selected hoist class valid (≥ P2.12)					
CL1	1Bm	M3	400	3 200	480 000	1 000
CL2	1Am	M4	800	6 300	1 134 000	1 000
CL3	2m	M5	1 600	12 500	3 000 000	1 000
CL4	3m	M6	3 200	25 000	7 500 000	1 000
CL5	4m	M7	6 300	50 000	18 000 000	1 000
CL6	5m	M8	12 500	100 000	42 000 000	1 000

4 Calibrate the load sensor circuit

The load sensor circuit is calibrated by 'entering' the output voltages of the load sensor with the 0 % and test loads to CU1. (CU1 will use these voltages to calculate the weight of the load.)

a) Verify that the correct load percentage value is shown on the display (e.g. 'SL100' for the 100 % load) and then lift the selected load. Press the blue push-button once and the CU1 responds by flashing the SL-value for three times.

b) Lower the load and check that the hook is empty. Verify that 'SL 00' is shown on the display. Press the blue push-button once and the CU1 responds by flashing the 'SL 00'-message for three times.

5 Exit the setup mode

a) Enter value 3-000 at password_3 to exit the setup routine and the CU1 responds by the 'PASS'-message. The setup routine has been completed and is stored in the CU1's memory. (Note: If you enter an other password at password_3 than 3-000, the CU1 responds with a 'FAIL'-message. The 'FAIL'-message means only that another than password 3-000 was entered and the message can be ignored.)

6 Carry out the startup routine to check that the setup was made correctly.

In case of mistakes, carry out the setup routine again.
If an error message 'Err_x' appears, the setup was not correct. See Appendix 2 for error messages and carry out the setup routine again.

6 TROUBLE SHOOTING

Carry out the trouble shooting according to the information given on the CU1's front panel (display and indicator lights).

If any of the red alarm lights is lit or blinking, check out if it is caused by a normal supervisory function (e.g. the hoisting motor is overheated).

If the problem still occurs follow the instructions given below. The wiring diagrams of the crane and a multimeter are needed during the trouble shooting.

By replacing the CU1 it is possible to determine if the failure is an external failure or caused by the CU1 itself. If a problem still exists after replacing the CU1, it is most likely an external failure.

Check always the external wiring and sensors before justifying that the CU1 is broken!

Fill in the CU1 control page (see Appendix 8) and follow the instructions given in Appendix 3 if the CU1 has to be changed.

Note:

If a CU1 must be bypassed during trouble shooting, note that all CU1's safety features are removed as well - remember to return the original connections after the trouble shooting!

6.1 CU1 looks normal but lifting does not work

First, check that there are no alarms on and no error-messages displayed!

1 Measure that control voltage exists at CU1:9 while the upwards push-button is pressed.

a) If there is no voltage, check the wiring between the control station and CU1:9.

2 Check the operation of the hoist inhibit switch inside the CU1. Bypass the CU1 by connecting a jumper between CU1:9 and CU1:10. See note 1!

a) If lifting now works properly, change the CU1.
    -If the fault still exists, check again the wiring and the function of contactor A-K1 (and A-K7).
b) Remove the jumper between CU1:9 and CU1:10.

6.2 An error-message (Err_x) is displayed

1 Notice always the first error-message displayed and see Appendix 2.

6.3 The red Temp-light is lit or blinking

1 See Chapter 3.5 to check the normal operation of the overheating protection circuit. Note the warning and cooling down periods (3 and 2 minutes).

2 Measure the resistance of the thermistors inside the hoisting motor.

a) Normal resistance is 150-1000 ohm (if the motor is overheated the resistance of the thermistors is more than 4200 ohm)

-If the resistance is out of normal range, check the thermistor wiring and renew the motor (thermistors) if necessary.

3 Bypass the thermistors by connecting a jumper between CU1:2 and CU1:1. See note 1!

a) If the alarm disappears after the cooling down and warning periods, check again the thermistors.

-If the thermistors are OK and the alarm still exists, change the CU1.

b) Remove the jumper between CU1:2 and CU1:1.

6.4 CU1's overload protector prevents lifting below the rated load

(I.e. the red LOAD-light is on with a load below the rated load of the hoist.)

1 See Chapter 3.6 to check the normal operation of overload protection circuit.

2 Make sure that there is no load on the hook and change the CU1 into the load mode.

a) If the load displayed differs more than ±5% from 'L 00', check the load sensor and its mounting. Recalibrate the load sensor (i.e. carry out setup routine) if necessary .

b) If the load displayed is 'L 0' (±5%) as it should be with no load, check the calibration of the load sensor according to the startup routine and recalibrate the load sensor if necessary.

6.5 The red Brake-light is lit or blinking

1 See Chapter 3.8 to check the normal operation of the brake wearing control circuit.

2 Measure the resistance of the brake wear sensor to check the condition of the brake.
a) Normal resistance is about 0 ohm and it is insulated from PE (ground).
 - If the resistance is very big or the brake wear sensor contacts to the PE (ground), check the wiring and renew the friction disks of the brake if necessary.

3 If the resistance is OK, bypass the brake wear sensor by connecting a jumper between CU1:15 and CU1:16 and try to lift. See note 1.

a) If the lifting works now correctly, check the brake again (step 2).
b) If the lifting doesn't work, check to see that there is voltage in CU1:11 and CU1:12 (ca. 18 VAC).
 -If the voltage is ca. 18 VAC, change the CU1.
c) Remove the jumper between CU1:15 and CU1:16.

6.6 The CU1's front panel is out and hoisting is prevented

1 Same action as with 'Err_3' trouble shooting. See Appendix 2.

6.7 The CU1 is hot and it doesn't work correctly

1 Check voltages between CU1:5 and CU1:6 (ca. 11 VAC) as well as between CU1:11 and CU1:12 (ca. 18 VAC). Note to check these voltages are at the CU1's connector.

a) If the voltages are reversed, check and correct the wiring.
b) If the voltages are OK, change the CU1.

6.8 The load sensor signal fluctuates

1 Check the fitting of the load sensor.

2 Measure the supply voltage to the load sensor between CU1:2 and CU1:4. It should be steady and about 9,85 VDC. Measure also the load sensor output signal voltage between CU1:2 and CU1:3 (3,9...6,6 VDC).

a) If the voltages are not OK, check the load sensor circuit. Note that the maximum current for the CU1's load sensor circuit is 100 mA.
b) If the voltages are OK, change the CU1.

APPENDIX 1: CU1 passwords

Note: **These passwords are to be used only by KCI Konecranes service organizations and their authorized service agents.**

Password_1 *Password_2* *Password_3*

1-000 CU1 information (≥ P2.12)
Displays the program version, hoist class code and selected/valid functional options
(e.g. P2.12; CL2; OPt2).

1-001 Additional information of the use of hoist (≥ P2.12)
Displays the
- **St-h** (number of starts per last hour)
- **LSt-h** (largest number of starts per hour)
- **St-10** (number of starts per last 10 min.) (≥ P2.13)
- **LS-10** (largest number of starts per 10 min.) (≥ P2.13)
- **bPC** (how many times password 1-125 has been used)
- **OH** (how many times the hoisting motor has been overheated)
- **brFC** (how many times the 'brake wear sensor' has been in *warning state*).

1-010 Setup counter (≥ P2.12)
Displays the
- **SUPC** (how many times the *setup routine* has been carried out)
- **SPCC** (how many times password 3-511 has been used).
- **hotrt** (for how long the overheated hoisting motor has been used for lowering) (≥ P2.13)

1-011 Load sensor calibrating voltages (≥ P2.12)
Displays the load sensor voltages:
- 0% load as '**0-x.xx**'
- 100% load as '**1-x.xx**'
- existing load as '**L-x.xx**'
- negative breaking load as '**UL-20**' or '**UL-10**' (i.e. load -20% or -10%).

Note the accuracy is ±0,15 VDC.

1-020 Decimals for SWP, RT and Starts values (≥ P2.13)
By using this password the exact values for SWP, RT and STARTS from the values displayed (mm for minutes and ss for seconds).
- **SWP (-mm.ss)** By reducing this value from the displayed SWP value, the exact SWP value can be calculated.
- **RT (mm.ss)** By adding this value to the displayed RT value, the exact RT value can be calculated.
- **STARTS** By adding this value to the displayed RT value, the exact STARTS value can be calculated.

1-100 Front panel test (≥ P2.12)
Lights up all lights and digits on the CU1's front panel for 5 seconds.

1-101 Factory setup with 110% load (≥ P2.12)
Note that this password can be used only once (normally at the hoist factory).

1-102 CU1 input values (≥ P2.13)
Displays status of each input on CU1:

- **Hr** (1 = Hoisting request detected on CU1:9).
- **Act** (1 = Hoisting motor running and/or brake released, CU1:13-14 closed)
- **Opt** (1=Motor overheating detected, thermistor resistance > 4,2kohm)
- **Li** (Value indicates the voltage incoming into AD-converter as percentage of 5V voltage; e.g. 4VDC=80)
- **brk** (1 = Brake wearing/status sensor OK i.e. resistance between CU1:15-16 » 0 ohm)

1-113 Internal diagnostic values (≥P2.00)
Displays the internal diagnostic values. These values give some extra information about the operation of the CU1.

Description	Original/present value	Description	Original/present value
int error address	A-FFFF/____	memory error	5___0/____
int err count	B-255/____	Err_b count	6_255/____
char error address	C-FFFF/____	Err_c count	7_255/____
char error count	D-255/____	Err_E count	8_255/____
crc error address	E-FFFF/____	overheat stops	9_255/____
crc error count	F-255/____	brake failure count	A___0/____
xram error count	1_255/____	Err_4 count	b_255/____
xram error address	2_255/____	Err_3 count	c_255/____
table error count	3_255/____	Err_9 count	d_255/____
table error address	4_255/____	Err_12 count	F_255/____

1-125 Load test mode
Bypasses the CU1's overload protector circuit. Note that the overheating and brake protector circuits are bypassed as well if the program version is earlier than P2.12.

1-400 *Message log: 10 last Err-messages* (≥ P2.13)

Displays the last 10 Err-messages and corresponding STARTS values for those. Also the following messages can be displayed:

- E 30 (the message log has been initialized)
- E 31 (CU1 has been started i.e. power switched on)
- E 32 (hoisting prevented because of overload; LOAD > 110%)
- E 33 (hoisting prevented because of underload; LOAD < -10/20%)
- E 34 (hoisting prevented because of overheating; TEMP)
- E 35 (hoisting prevented because of brake alarm; BRAKE)
- E 36 (lowering motion of the motor has been used when brake alarm was on)
- E 37 (hoisting prevented, reason unknown)

1-401 *Err-message log: number of Err-message situations* (≥ P2.13)

Displays the total number of above mentioned Err-messages.

1-630 *Beginning of the programming and controlling mode*

Shifts the CU1 into the programming and controlling mode.

2-611 *Setup mode, procedure 1*

Load sensor calibrating with 0 and 100 % loads.

2-622 *Setup mode, procedure 2*

Load sensor calibrating with 0 and 50-99 % loads.

2-601 *Setup mode, procedure 3* (≥ P2.12)

Load sensor calibrating with 0 and 110 % loads.

2-645 *Setup mode, procedure 4* (≥ P2.12)

Load sensor calibrating with 0 and 125 % loads.

2-224 *Checking of supervisory values* (≥ P2.12)

Checks SWP, Run Time, Starts and Overload values (i.e. a memory test).

2-410 *Initalization off Message log*

Initilizates the Message logs 1-400 and 1-401

2-865 *Option 1; Bypassing of low voltage detector for 0,5 sec* (≥ P2.12)

Bypasses the low voltage detector for 0,5 seconds during starting (and while driving ≥P2.13) the hoisting motor (see Appendix 6).

2-764 *Option 2; Changing direction* (≥ P2.12)

Changes the operation of CU1's internal check routine in order to avoid Err_10 situation when changing direction from downwards to upwards (see Appendix 6). This option is normally selected always as factory default ≥P2.13).

2-393 Option 3; DynAHoist option; Ready-output (≥ P2.12)
Changes the operation of the Ready-output. This enables the Ready-output to be connected to the DynAHoist's fault circuit (see Appendix 6).

2-413 Option 4; Brake sensor (≥ P2.13)
Changes the operation of the brake wear sensor input (see Appendix 6).

2-433 Option 5; External overload alarm (≥ P2.13)
An external overload alarm/warning can be controlled via CU1:7-8 (see Appendix 6). Can not be used simuntaneously with Option 3.

2-425 Option 6; External overtemperature and brake failure indicator (≥ P2.13)
An external overtemperature and brake wearing alarm/warning can be controlled via CU1:7-8 (see Appendix 6). Can not be used simuntaneously with Option 3.

2-000 Shifts CU1 into the 3rd programming level
Allows the use of password 3-511.

3-511 Changing of supervisory and diagnostic values

- *SUP0* Reset all supervisory values
- *SUP1* Set SWP (one can enter e.g. an old SWP-value from a replaced CU1)
- *SUP2* Set Runtime
- *SUP3* Set Starts
- *SUP4* Set Overloads
- *SUP5* Set SWP, Runtime, Starts and Overloads
- *SUP6* Reset hoist use values: St-h, LSt-h, OH and brFC (see 1-001)
- *SUP9* Reset CU1's internal diagnostic values.

3-000 Exit
Exits the *programming and controlling mode* (PAUSE-message displayed).

3-xxx Exit
Exits the *programming and controlling mode* (if a FAIL-message is displayed, it can be ignored).

APPENDIX 2: CU1 error messages

Some error messages are shown continuously and other messages are displayed for a moment only (i.e. as long as the failure is active).

In the case that two error messages are displayed one after another, notice the first one displayed because it may be the most relevant.

Err_0: SETUP ERROR - A wrong code has been entered as password_1.

Normal action: Repeat the *setup routine*. Check the password code. If this does not help, change the CU1.

Err_1: MEMORY ERROR, RESET - Memory content or check sum is not correct after a reset or switching power on.

Normal action: Switch the power off for at least 5 seconds. If this does not help, change the CU1.

Err_2: MEMORY ERROR, DRIVE - Memory content or check sum is not correct after a drive (the CU1 is not able to correct the error).

Normal action: Switch the power off for at least 5 seconds. If this does not help, change the CU1.

Err_3: MAINS UNDERVOLTAGE - CU1 detects that supply (control) voltage is too low

Normal action: Measure the 11 VAC power supply for the CU1 (CU1:5 and CU1:6). It should be about 11 VAC (see Appendix 11). Measure the voltage at the CU1's connector.

-If the 11 VAC voltage is out of range, check the hoist's control voltage and the voltage at the CU1's transformer (O-T2).

-If the 11 VAC voltage is out of range during starting the hoisting machinery, check the power supply cables.

-If the 11 VAC voltage is OK, change the CU1.

Err_4: HIOK OUTPUT CIRCUIT FAILURE (≥ P2.10) - The voltage detector circuit may be faulty (the HIOK circuit checks that the CU1's *hoist inhibit switch* between CU1:9 and CU1:10 operates correctly).

Normal action: If this error message appears repeatedly, change the CU1.

Err_5: LOAD SENSOR CALIBRATION ERROR - The no-load (SL 0) setting voltage is out of range.

> Normal action: Repeat the setup routine. Measure the voltage between CU1:2 and CU1:3 (values should be found somewhere in the range of 3,9 - 6,1 VDC with any load from 0 to 100 %).

Err_6: LOAD SENSOR CALIBRATION ERROR - The full-load (SL100) setting voltage is out of range.

> Normal action: The same action as with the Err_5.

Err_7: LOAD SENSOR CALIBRATION ERROR - The voltage difference between the no-load (SL 00) and full-load (SL100) setting voltages is too low.

> Normal action: Repeat the setup routine. If the error still occurs check the load sensor and its mounting. The voltage difference measured between CU1:2 and CU1:3 must be at least 0,4 VDC between the no-load and full-load settings.

Err_8: MEMORY ERROR, UPDATE - the CU1 has failed to update its memory content.

> Normal action: Switch the power off for at least 5 seconds. If this does not help, change the CU1.

Err_9: SYSTEM ERROR (≥ P2.02)

> Normal action: Switch the power off for at least 5 seconds. If this does not help, change the CU1.

Err_10: CU1:9-10 CHECKING FAILURE (≥ P2.11) - The CU1 has detected a continuous hoisting request in non-active state (*active signal*, CU1:13-CU1:14, is OFF but hoisting request is ON) - i.e. this error message is displayed if the hoisting request is not requested by a crane operator or the hoisting direction is changed very rapidly from downwards to upwards. (CU1 checks that the *hoist inhibit switch* between CU1:9 and CU1:10 operates correctly).

> Normal action: Check hoisting request circuit that the hoisting request is OFF when it should be. If there is voltage on CU1:9 (> 30 VAC) without a hoisting request, check the hoisting control circuit.
>
> The Err_10 may also be caused because of very long control wires i.e. capacitance on wires is too large. In that case connect a RC-circuit between CU1:9 and control voltage neutral (e.g A-K1:A1). If this does not help replace the CU1.

Err_11: TOO LONG AD-CONVERSION TIME (≥ P2.13) - CU1 detects, that the AD-conversion time is too long when power is switched on.

Normal action: Switch the power off for at least 5 seconds. If this does not help, change the CU1.

Err_12: OVERTEMPERATURE INSIDE CONTROL PANEL (≥ P2.13) - CU1 has detected that the temperature inside the control panel is too high.

Normal action: Check the temperature of CU1 - If the temperature is > 50°C inside the control panel, wait till it is back to normal. If this does not help, change the CU1.

Err_A: MEMORY ERROR, EPROM - The check sum of the program memory is not correct.

Normal action: Switch the power off for at least 5 seconds. If this does not help, change the CU1.

Err_b: A BLOCKED HOIST ERROR (≥ P2.03) - The CU1 has detected a possible fault in its internal safety circuit.

This error may also occur when the lifting request (UP command) has been ON only for a very short time (less than 0,5 sec) - in this case no further actions required.

Normal action: Switch the power off for at least 5 seconds. If this does not help, change the CU1.

Err_c: HOIST ACTIVE ERROR: The CU1 has detected that the hoisting contactor is not working correctly (i.e. the hoist active signal is not received). Lifting is prevented for safety reasons.

Normal action (after accepting HOIST UP command):

1 Check to see if the CU1 switches the display off during lowering motion.
  - -If the display is switched off, check the wiring of hoisting and brake contactors (A-K1 and A-K7). The *active signal (CU1:13-CU1:14)* must be switched in 150 msec (≤ P2.12) or in 1 sec (≥ P2.13) after hoisting request appears at CU1:9.

2 Measure the voltage between CU1:13 and CU1:14 during standstill (ca. 18 VAC).
  - -If the 18 VAC voltage is missing, check the 18 VAC voltage at the CU1's transformer (O-T2).

3 Measure the voltage between CU1:13 and CU1:14 during lowering motion (ca. 0 VAC).
  - -If the 18 VAC voltage still exists, check the wiring of the hoisting and braking contactors (A-K1, A-K2 and A-K7).
  - -If the voltage is ca. 0 VAC, change the CU1. Check also that the ambient temperature inside the electrical cubicle is within specified limits (-25...+50°C).

Err_d: LOAD SENSOR ERROR (≥ P2.03) - The load sensor signal is out of normal range (3,9-6,1 VDC).

Normal action:

1 Check the wiring and fitting of the load sensor.

2 Measure the voltage between CU1:2 and CU1:4 (ca. 9,85 VDC).
-If the voltage is ca. 9,85 VDC, continue at step 4.

3 Switch the power off. Disconnect the load sensor wire from CU1:4. Switch the power on and measure the voltage between CU1:2 and CU1:4 (ca. 9,85 VDC).
-If the voltage is ca. 9,85 VDC, change or fix the load sensor.
-If the voltage is not ca. 9,85 VDC, check that current in the load sensor circuit is less than 100 mA, and if necessary, change the load sensor or the CU1.
-Reconnect the load sensor wire to CU1:4.

4 Measure the load signal voltage between CU1:2 and CU1:3 (3,9 - 6,1 VDC).
-If the load signal voltage is within the range, 3,9 - 6,1 VDC, change the CU1.

5 Switch the power off. Disconnect the load sensor wire from CU1:3. Switch the power on.
-If the load signal voltage measured from the wire is still out of the range, change or fix the load sensor.
-Reconnect the load sensor wire to CU1:3.

6 Carry out the normal *startup routine* to ensure that the load sensor and the CU1 work correctly.

Err_E: HOIST REQUEST ERROR (≥ P2.10) - The CU1 has detected that the lifting request was not ON for sufficient time to test its internal circuit (time required is about 0,15 sec).

Normal action: Normally does not require any actions. If the lifting request has been ON for more than 0,15 seconds constantly and Err_E occurs repeatedly, change the CU1.

Err_F: HIOK INPUT FAILURE (≥ P2.11) - The HIOK signal is ON when it should be OFF (hoisting contactor A-K1 is energized). (The HIOK circuit checks that the CU1's switch between CU1:9 and CU1:10 operates correctly).

Normal action: Replace the CU1.

FE 1x: INTERNAL RAM ERROR (≥ P2.10) - (x could be any number between 0
FE 2x: to 9 or any letter between A to F.) CU1 has found an error in the internal RAM and does not resume to normal operation.

Normal action: Switch the power off for at least 5 seconds. If this does not help, change the CU1.

FE 3x: INTERNAL EEPROM ERROR (≥ P2.10) - (x could be any number between 0 to 9 or any letter between A to F.) CU1 has found an error in the internal data memory EEPROM and does not resume to normal operation.

Normal action: Switch the power off for at least 5 seconds. If this does not help, change the CU1.

FE 4x: INTERNAL AD CONVERTER ERROR (≥ P2.10) - (x could be any number between 0 to 3.) CU1 has found an error in the internal AD converter and does not resume to normal operation.

Normal action: Switch the power off for at least 5 seconds. If this does not help, change the CU1.

FE yy: INTERNAL CHECK ERROR (≥ P2.10) - (yy could be any number between 0 to 9 and any letter between A to F.) CU1 has found an error in internal circuit and does not resume to normal operation.

Normal action: Switch the power off for at least 5 seconds. If this does not help, change the CU1.

APPENDIX 3a: How to replace a CU1

In this appendix, it is described how to replace a CU1-unit by a new one, and how to enter existing supervisory values into the new unit. The new CU1-unit is calibrated with a test load.

1 Fill in the CU1 control page (see appendix 8).

2 Switch the power off and replace the CU1 with a new one.

3 Switch the power on and carry out the *setup routine*.

4 Carry out the normal *startup routine* to check that the *setup routine* was carried out correctly.

5 Measure the load sensor voltages between CU1:2 and CU1:3 with the 0 % and 100 % loads and write down the load sensor voltages on the CU1 control page.

6 Update the old supervisory values from the old CU1 into the new one:

  a) Change the CU1 into the *beginning of the programming and controlling mode* by entering value 1-630 as password_1.

  b) Enter value 2-000 as password_2.

  c) Enter value 3-511 as password_3 and select function SUP5.

  d) Enter the SWP, Runtime, Starts and Overloads supervisory values into the new CU1.

7 Check that the supervisory values were updated correctly.

APPENDIX 3b: How to replace a CU1 (without a test load)

In this appendix, it is described how to replace a CU1-unit by a new one without a test load. It is also described how to enter existing supervisory values into the new unit.

It is always recommended to use a test load for setting up a CU1. However, if a test load is not available, it is possible to replace a CU1 without a test load.

In this routine, with a *calibrating load sensor* and a multimeter, the technician can measure the load sensor voltages at 0 % and 100 % loads (i.e *setting voltages*) and input those voltages into the new CU1.

Before changing the CU1, make this instruction clear to yourself!

1 Fill in the CU1 control page (see appendix 8).

2 Change the CU1's display into the *load mode* and check the mounting of the hoist's load sensor.
Check that 'L 0' is displayed with no load on the hook, if not, see Appendix 4 (steps 3, 4 and 5) or Appendix 5 how to refit the hoist's load sensor.

Note: After the hoist's load sensor has been checked (and refitted if needed), it is not necessary to fix again its mechanical position during this routine.

3 Switch the power off. Disconnect the hoist's load sensor wires (CU1:2,3,4) and connect the *calibrating load sensor* (CU1:2,3,4) and a voltage meter (CU1:2,3). See Figure 1.

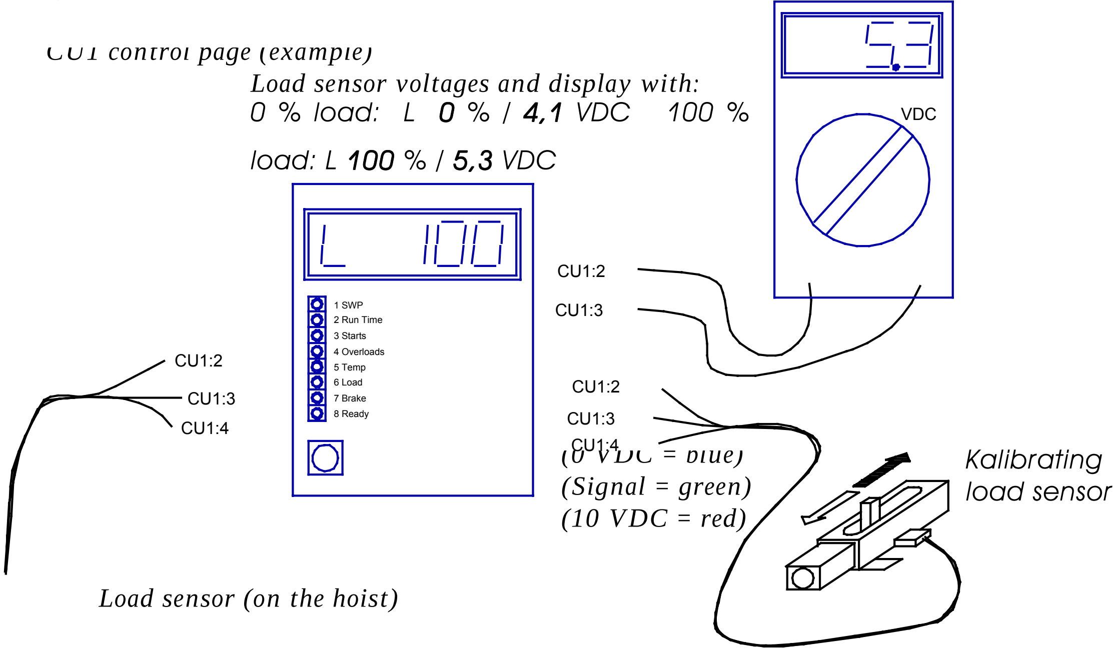


Figure 1. Connections of a calibrating load sensor and a voltage meter.

4 Switch the power on. Change the CU1's display into the *load mode*. Measure the no-load ('SL 00') and full-load ('SL100') *setting voltages* between CU1:2 and CU1:3 and write down the voltages on the CU1 control page:

a Adjust by the *calibrating load sensor* the CU1 to display 'L 00' (this is the 'SL 00' voltage) and read the load sensor voltage.

b Adjust by the *calibrating load sensor* the CU1 to display 'L 100' (this is the 'SL100' voltage) and read the load sensor voltage.

5 Switch the power off and change the CU1.

6 Switch the power on and *setup* the new CU1.

Use the *calibrating load sensor* and the voltage meter to set the 'full-load' ('SL100') and 'no-load' ('SL 0') settings into the new CU1 during the load sensor calibration phase of the *setup routine*. Set the same voltages as measured in step 4.

7 After the calibration has been done, change the CU1's display into the *load mode* and check that *setup* was carried out correctly. Adjust the CU1 to display 'L 0' and 'L 100' by the *calibrating load sensor*, and compare the display readings with the measured voltages.

8 Switch the power off and disconnect the *calibrating load sensor* and the voltmeter.

9 Reconnect the actual load sensor of the hoist and switch the power on.

10 Carry out the normal *startup routine* to check that *setup routine* was carried out correctly. (The accuracy of the load displayed must be ±5% - if not, continue on step 11.)

Continue on step 11 only when recalibration is needed, otherwise go to step 14:

11 (The reason for the recalibration may be that the new CU1 has somewhat different supply voltage for the load sensor than the old one.)

Measure the load sensor voltage between CU1:2 and CU1:3 with no load on the hook. (It will be slightly different from the previous, on step 4a measured 'L 0' voltage.)

12 Calculate the voltage difference between 'L 0_{step4a}' and 'L 0_{step11}' voltages.

Add the calculated voltage difference (positive or negative) to the 'L 0_{step4a}' and 'L 100_{step4a}' voltages and write those down as new 'SL 0' and 'SL100' setting voltages.

(The aim is to keep the voltage difference between 'full-load' and 'no-load' the same as with the old CU1 and get the new CU1 to display 'L 00' when there is no load on the hook.)

13 Switch the power off. Disconnect the load sensor wires (CU1:2,3,4) and connect the *calibrating load sensor* (CU1:2,3,4) and a voltage meter (CU1:2,3). See Figure 1.

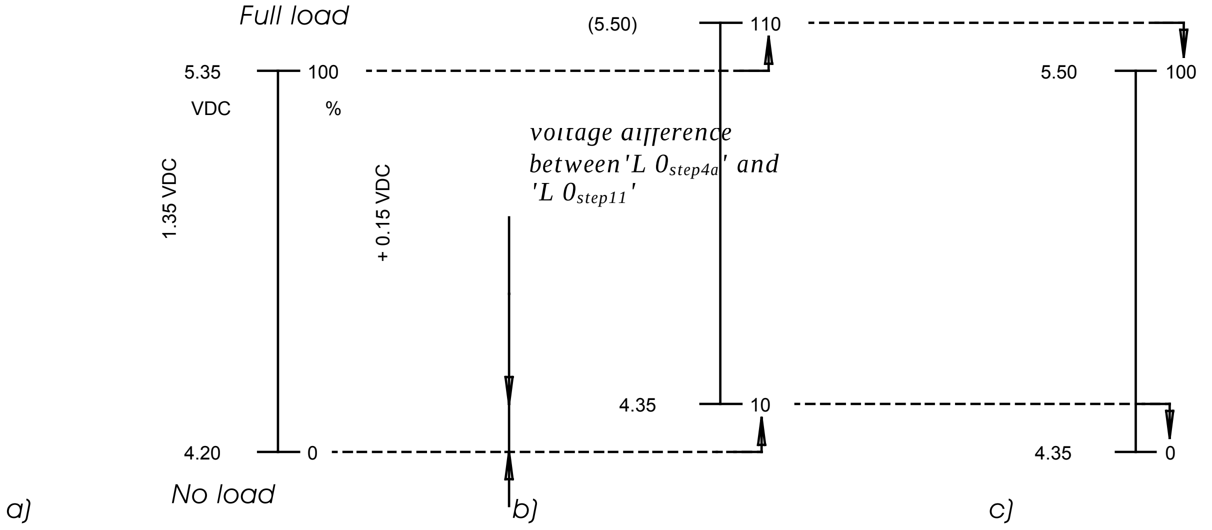
Continue on step 6 and *setup* the new CU1 again with the new calculated 'SL 0' and 'SL100' setting voltages.

Example (see Figures 2a, 2b and 2c):

a) The 0 % and 100 % voltages measured were 4.20 and 5.35 VDC (step 4).

b) However, after replacing the CU1 the 'no load' value displayed was 10 % (L 10). The remeasured 0 % voltage on step 11 was 4.35 VDC. Thus, the calculated voltage difference between the 'L 0_{step4a}' (4,35 VDC) and 'L 0_{step11}' (4,20 VDC) voltages was +0.15 VDC (step 12).

c) Now the new CU1 has to be recalibrated with the calculated 'full load' ('SL100' = 5,50 VDC) and 'no load' ('SL 0' = 4,35 VDC) voltages (step 13).



'L 0'- and 'L 100'-voltages and loads displayed with the original CU1 (see step 4)

'L 0'-voltage and load displayed with the new CU1 (see step 10)

'L 0'-and 'L 100' voltages and loads displayed after recalibration (see step 11)

Figure 2. An example on recalibration

Note: If a CU1 has been replaced, the old supervisory values (SWP, Runtime, Starts and Overloads) have to be entered into the new CU1.

14 Update the old supervisory values from the old CU1 into the new one:

   a Change the CU1 into the *beginning of the programming and controlling mode* by entering value 1-630 as password_1.

   b Enter value 2-000 as password_2.

   c Enter value 3-511 as password_3 and select function SUP5.

   d Enter the SWP, Runtime, Starts and Overloads supervisory values into the new CU1.

15 Check that the supervisory values were updated and repeat step 14 if necessary.

APPENDIX 4:How to replace a load sensor (Linear type)

The purpose of this instruction is to avoid the CU1 *setup routine* when linear type of load sensor is renewed because of damage. This instruction is based on the fact that the linearities of the load sensors are identical.

Note: **The CU1 *setup routine* must always be carried out if a strain-gauge load sensor has to be renewed (see Appendix 5).**

1 Fill in the CU1 control page (see Appendix 8).

2 Switch the power off. Remove the damaged load sensor and disconnect its wires (CU1:2,3,4). Install and connect a new load sensor.

3 Switch the power on. Change the CU1's display into the *load mode*. Adjust the position of the new load sensor so that the CU1 displays 'L 00' without a load on the hook (see Figure 1). If it is not possible to achieve the 'L 00'-value, then the CU1 *setup routine* has to be carried out).

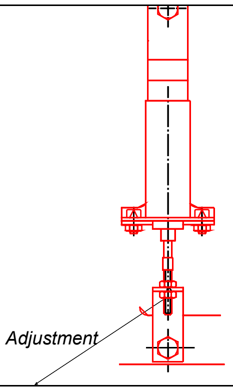
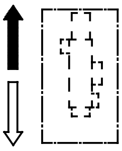
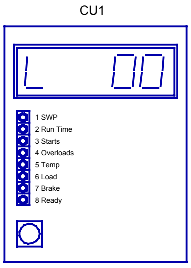
New model	Old model (Hall)	CU1
	Load sensor on the hoist 	 CU1 L 00 1 SWP 2 Run Time 3 Starts 4 Overloads 5 Temp 6 Load 7 Brake 8 Ready

Figure 1. Adjusting of the position of linear load sensor.

4 Fasten the fixing screws of the load sensor with care.

5 Change the CU1 into the *load mode*. Lift the rated load of the hoist (or a load as close to the rated load as possible, max. 110 %) to ensure that the CU1 displays the correct load value. If the load displayed differs more than ±5 % from the correct load value, carry out the *setup routine*.

APPENDIX 5:How to replace a load sensor (Strain-gauge type)

If a strain gauge type of load sensor has to be renewed because of damage, the CU1 must always be recalibrated with a test load. (Due to the fact that the strain-gauge load sensors are not identical.)

1 Replace the damaged strain-gauge type of load sensor.

3 If necessary, readjust the load sensor amplifier. (In case of ESD142 or ESD119 amplifier, see Appendix 7).

4 Carry out the CU1 *setup routine*.

APPENDIX 6: Functional options

The CU1's functional options are switched ON or OFF by level 2 passwords. By entering password 1-000 (≥P2.12) CU1 displays the selected options (e.g. 'Opt 1').

Option 1; Low voltage detector (≥ P2.12) [Password 2-865]

This option can be used in the case that an Err_3-situation occurs during starting of the hoisting machinery because of voltage drop in power supply lines.

Option 1 passes the low voltage detector for 0,5 seconds when starting the hoisting motor and in new versions (≥ P2.13) also while the hoisting motor is running.

Note: The torque of the hoisting motor depends on the supply voltage - if the voltage drop is too big when starting the hoisting motor, it is possible that the hoist is not able to lift the nominal load due to low voltage and the hook may go down despite of up request!

Option 2; Changing of direction (≥ P2.12) [Password 2-764]

Option 2 changes the operation of CU1's internal check routine. Normally this property is always activated as factory default since ≥ P2.13.

Option 3; DynAHoist option; Ready-output (≥ P2.12) [Password 2-393]

This option is allowed to use with DynAHoist only.

By using this option, it is possible to connect the CU1's Ready-output to the DynAHoist's fault circuit (i.e. if the CU1 detects a safety risk the DynAHoist will be stopped immediately.)

Note: If Option-3 is selected, the Ready-output CU1:7-CU1:8 does not operate similarly as the Ready-light on CU1's front panel (and thus the Remote indicator can not be connected to the Ready-output).

Option 3 changes the operation of the Ready-output so that the Ready-output is OFF in case of alarm due to *Temp*1), *Load*2) or *Brake*2).

1) Ready-output is OFF as long as the Temp-alarm is on - this prevents also lowering with DynAHoist.

2) Ready-output is OFF for 0,5 seconds when trying to drive upwards as long as the Load- or Brake-alarm is on. Lowering is possible.

Option 4; Control of brake status (≥ P2.13) [Password 2-413]

The new not-automatically adjusting brakes are equipped with a micro switch monitoring the status of hoisting motor's brake i.e. it is closed/open. If the option is activated and the micro switch is off (brake is not released i.e it is closed but it should be open) the motor running is prevented.
This option is activated by using the password.

Option 5; Overload alarm by remote indicator (≥ P2.13) [Password 2-433]

This option changes the operation of remote indicator circuit (CU1:7-8) that an overload alarm/warning can be given e.g. by an external horn/light. The overload alarm is given at least for 5 sec time.

Note: This option can not be used simultaneously with Option 3.

The alarm mode is selected by the following codes:

'ol c-'	constant overload1) alarm >110%
'ol -c'	constant overload1) alarm >90...109% (adjustable)
'ol cb'	constant overload1) alarm 110% and blinking2) warning 90...109%
'ol --'	removing of overload alarm (i.e. this option)

Option 6; Overtemperature/brake wear alarm by remote indicator (≥ P2.13) [Password 2-425]

This option changes the operation of remote indicator circuit (CU1:7-8) that an overtemperature/brake wearing alarm/warning can be given e.g. by an external horn/light.

Note: This option can not be used simultaneously with Option 3.

The alarm mode is selected by the following codes:

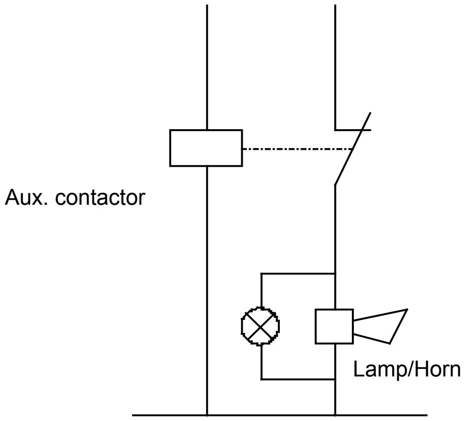
'ob c-'	constant overtemperature1)/brake1) alarm
'ob cb'	constant overtemperature1)/brake1) alarm and blinking4) brake warning
'ob bb'	blinking overtemperature3)/brake4) alarm and blinking4) brake warning
'ob --'	removing of overtemperature/brake alarm (i.e. this option)

Connection of remote indicator circuit with Options 5 and 6

Function of remote indicator circuit CU1:7-8 (alarm is given while CU1:7-8 is OPEN):

Alarm sequences:

1) continuously OPEN
2) 1sec OPEN, 20sec CLOSED, ...
3) 3sec OPEN, 3sec CLOSED, 1sec OPEN, 20sec CLOSED,...
4) 3sec OPEN, 3sec CLOSED, 3sec OPEN, 3sec CLOSED, 1sec OPEN, 20sec CLOSED,...



APPENDIX 7: How to adjust ESD142 amplifier

The ESD142 amplifier amplifies the load sensor signal coming from a strain-gauge type of load sensor to the suitable voltage level for the CU1.

Note: The ESD142 replaced the ESD119 on Feb 1991.

ADJUSTMENT WITH THE RATED LOAD OF THE HOIST

NO LOAD ON THE HOOK:

a Check that there is no load on the hook.

b Adjust the trimmer 'ZERO' to counterclockwise until the light '0%' goes on.

c Adjust the trimmer 'ZERO' back to clockwise until the light '0%' goes off. Now the output signal should be about 4 VDC - it can be measured between the terminals 1 and 3.

THE RATED LOAD (100 %) ON THE HOOK:

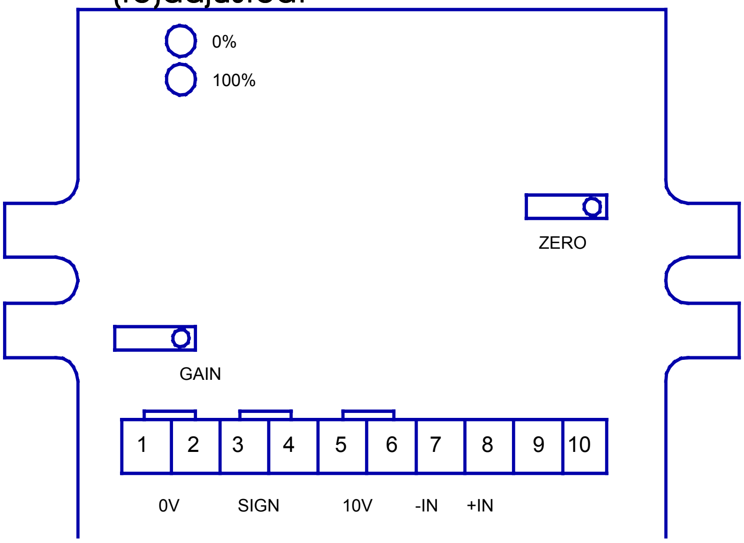
Note: You may have to use the password 1-125 to bypass CU1's overload protection when lifting a test load.

d Lift up the rated load of the hoist.

e Adjust the trimmer 'GAIN' clockwise until the light '100%' goes on.

f Adjust the trimmer 'GAIN' counterclockwise until the light '100%' goes off. Now the output signal should be about 6 VDC - it can be measured between the terminals 1 and 3.

Note: CU1 must always be setup after the load sensor amplifier has been (re)adjusted!



Wiring:

Terminal	*Signal*	*To/Color*
1	*0 VDC*	*CU1:2*
2	*0 VDC*	*Load sensor (-Exc/Blue)*
3	*Signal*	*CU1:3*
4	*Signal*	*Not connected*
5	*10 VDC*	*CU1:4*
6	*10 VDC*	*Load sensor (+Exc/Red)*
7	*-IN*	*Load sensor (-Out/Yellow)*
8	*+IN*	*Load sensor(+Out/Green)*
9	*SHLD*	*Load sensor (shield)*
10	*4 VDC*	*Not connected*

APPENDIX 8: CU1 control page (Fill in this page always before changing a CU1)

Date and name:

*Customer:*____ __
____

Hoist type and serial number: Type: ____________*No:*________ ________

CU1 program version and serial number: Ver P ___________*No:* ________ ________

*Valid options (read with password 1-000, ≥ P2.12): Opt*________________ ________

Supervisory values:

SWP ________	Run Time ________	Starts ________	Overloads _______

Load sensor voltages and display with

0% load L_______/_______VDC	______% load L_______/_______VDC

Type of load sensor: Linear / Strain gauge (amplifier type: __________)
By using the following passwords, CU1 gives more information about the operation of the hoist:

Message logs (≥P2.13)
By examing the last error messages one can easily analyze recent use of the hoist

Password 1-400 (last 10 Err-messages and corresponding STARTS values by last 4 digits)

1 ____________ ____________ 1 ____________ ____________
2 ____________ ____________ 2 ____________ ____________
3 ____________ ____________ 3 ____________ ____________
4 ____________ ____________ 4 ____________ ____________
5 ____________ ____________ 5 ____________ ____________

Password 1-401 (total number of Err-situations)

1 ____________ ____________ 1 ____________ ____________
2 ____________ ____________ 2 ____________ ____________
3 ____________ ____________ 3 ____________ ____________
4 ____________ ____________ 4 ____________ ____________
5 ____________ ____________ 5 ____________ ____________

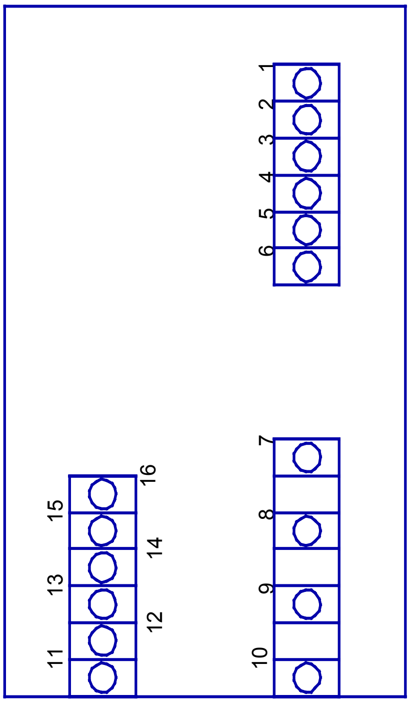
Diagnostics values (see Appendix 1; password 1-113, ≥P2.00)

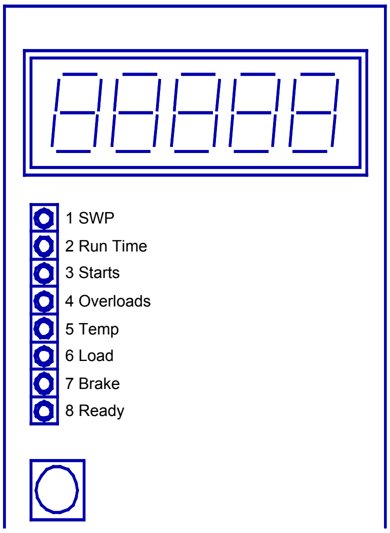
Additional Information of the use of the hoist (password 1-001 ≥ P2.12)
Displays the

- ST-h (numbers of start per last hour)
- LSt-h (largest number of starts per hour)
- St-10 (number of starts per last 10 min) (≥P2.13)
- LS-10 (largest number of starts per 10 min) (≥P2.13)
- bPC (how many times password 1-125 has been used)
- OH (how many times the hoisting motor has been overheated)
- BrFC (how many times the “brake wear sensor” has been in warning state)

APPENDIX 9: CU1 connectors - marking

The following figure shows the marking of CU1 connectors (CU1s have been equipped with connectors since July 1990).





Thermistor input

(if the resistance in the thermistor circuit is more than 4,2 kW, CU1 cuts off lifting)

CU1:1	Thermistor input
CU1:2	Thermistor input 0 VDC (CU1 common - also load sensor common)

Load sensor input

CU1:2	0 VDC (CU1 common - also thermistor ground)
CU1:3	Load signal (input)
CU1:4	10 VDC (supply to the load sensor)

Power supply, 11VAC

(low voltage detector via this supply, there is an internal fuse in this supply)

CU1:5	11 VAC input (internal fuse in this input)
CU1:6	11 VAC input

Remote indicator switch (triac)

(normally the switch is closed, in the *alarm state* it blinks at 0,5Hz)

CU1:7	Remote indicator input (42...230 VAC, max 1 A)
CU1:8	Remote indicator output

Hoist inhibit switch (triac and switch)

CU1:9	Hoisting request input (42...230 VAC)
CU1:10	Hoisting request output

Power supply, 18VAC

CU1:11	18 VAC input
CU1:12	18 VAC input

Hoist active input

(this input must be closed within 150 msec (< P2.12) or within 1 sec (≥ P2.12) after hoisting request art CU1:9.)

CU1:13	18 VAC supply for hoist active switch
CU1:14	Hoist active input

Brake condition detector

CU1:15	18 VAC supply for brake wear sensor
CU1:16	Brake wear sensor input

APPENDIX 10: CU1 program versions

This appendix lists the main modifications of the CU1's program.

Version P2.00

- The form of the passwords have been changed (e.g. 1-xxx)
- the Err_A message has been added
- The load is displayed within range -20...120 %
- The internal diagnostic values can be read with the password 1-113
- The HIOK circuit is not tested if it is less than 5 seconds since the previous lift.
- The 'hoisting motor running (active)'-data is waited for 150 msec
- A 'PASS'-message is displayed after the password 3-000.
- It is possible to enter into the *programming mode* with the blue push-button in standstill.
- It is possible to calibrate the load sensor with a 50...99% load instead of 100%.

Version P2.01

- The Err_b and Err_C messages have been added.
- The diagnostic values can be reset by the password 3-511/sup 9.
- The number of overloading incidents is updated after 5 seconds standstill.
- The cooling down and warning state times have been modified to be 2 and 3 minutes.
- If the load is less than -10% it blocks out lifting after 4 seconds time.

Version P2.02 (from serial no. N890150, December 1989)

- The Err_9 message has been added

Version P2.03 (from serial no. N890290, February 1990)

- CU1's circuit board has been modified, D19 and D20 removed
- The password 1-125 has been added
- The Err-d messages has been added
- In the *setup mode* full and no-loads are asked as 'SLxxx' and 'SL 0'
- The weight of the load is displayed as 'L XXX' in the *load mode*

Version P2.10 (from serial no. A900127, September 1990)

- The Err_4 and Err_E messages have been added
- Diagnostic values have been added (8-, 9-, A-, b-)

Version P2.11 (from serial no. A900919, May 1991)

- The Err_10- and Err_F messages have been added

Version P2.12 (from serial no. A921210, November 1992)

- The password 1-000, 1-001, 1-010, 1-011, 1-100, 1-101, 2-224, 2-601, 2-645 and 2-865 have been added
- SUP6 added to password 3-511
- The functional options 1, 2 and 3 have been added
- Err_3, low voltage detector is activated if 11VAC voltage is -15% for 25 msec time (before the program version P2.12 it was -10%, no delay)
- If password 1-125 is used, the overheating and brake wear control circuits remain valid
- FEM-group 5m has been added (CL 6) as well as code CL0 that keeps the earlier selected FEM-class valid

- Leading zeros while displaying SWP, RunTime etc. have been removed to enhance readability.

Version P2.13 (from serial no. xxx, May 1994)

- The passwords 1-020,1-102,1-400,1-401,2-410,2-413,2-433 and 2-425 added
- Err_11 and Err_12 added
- Low voltage detector circuit modified (Functional Option 1)
- Functional Options 4,5 and 6 added

APPENDIX 11: CU1 technical data

Rated control voltage range:	42 VAC - 230 VAC (-10% to +15%)
Supply voltages:	11 VAC and 18 VAC -low voltage detector in 11VAC circuit operates if U11VAC is a) -15% for 25 msec time (≥ P2.12) b) -10% with no delay (< P2.12)
Frequency:	50/60 Hz
Operating ambient temperature:	-20°C to +55°C
Storage temperature:	-30°C to +90°C
Humidity:	90%RH (no condensation)
Mechanical dimensions (mm):	70 x 75 x 100 (Width x Height x Depth)